containing most air tubes lie within the upper half of a given section of ice. The presence or absence of air tubes within ice is doubtless largely due to the rapidity of the rate of the growth of the ice. All things being equal, ice that forms rapidly and during intense cold will contain many air tubes, while conversely, ice that forms slowly will possess but few air tubes. Ice that forms by accretionary processes over swiftly flowing water contains but few air tubes. The forms and sizes of the air tubes within the pond and lake ice vary greatly from one section or layer to another. Some layers may contain only long and slender tubes, others cigar-shaped ones, while others may contain small or large, oval or round tubes. (See photograph No. 230 C). They seem to be subjected to great pressure, for they are often foreshortened as tho by intense stress. This seems proved from the fact that air tubes of a given size, after the ice has been subjected for a time to sunlight or to mild temperatures, are found to extend farther than in the first instance, owing to the fact that a slight internal melting has resulted in revealing the original former dimensions of the tubes as they existed before internal pressure constricted them. (See photograph No. 230 D.)

(62) Various ice-crystal forms.

Ice crystals develop largely if not wholly upon thin tabular or discoidal planes, and a large proportion form and grow in segmental form only. The great majority assume branch-like, leaf-like, or needle-like forms, but complete crystals or "ice flowers" having six leaf or branch-like rays, arranged symmetrically like those of snow crystals, are not rare. Ice crystals seem rarely or never to assume the form of the solid or hollow six-sided column, or to develop in a trigonal manner. They nearly all resemble one another in this, that their outlines are soft and curving, rather than hard, abrupt, and facet-like, and in this they vary markedly from most snow crystals. The primary or germ forms of each of the several types of ice crystals are at first very dissimilar in form one to another; but as they develop, they tend to grow more and more in a common branch-like manner, and hence when mature resemble one another more closely than at birth.

(63) First formation of ice crystals.

Ice crystals when first formed, tho free from air tubes and inclusions, are yet lighter than water, and if unattached to anything always rise to the surface and remain resting thereon, usually with their tabular planes lying parallel to the surface. In general, germ ice crystals form more slowly in perfectly calm than in slightly agitated water. When the whole of a body of water becomes chilled to a certain degree, a gentle stirring of the water, a jar, or a rocking of the receptacle containing it causes myriads of germ crystals to form with amazing suddenness both upon and beneath the surface of the water.

(64) Diversity of types.

Perhaps the most surprising fact in connection with the formation and growth of ice crystals is this, that so many diverse types form and grow, each perhaps in a different manner, at the same time within or upon a given body of water, and apparently under the same identical conditions of temperature, air pressure, environment, etc. Photograph No. 262 shows crystals of various types, formed and growing in the manner described. Changes of temperature seem not to lead to either a marked increase or a decrease in the number of different germ types forming at a given time; tho cold hastens and milder temperatures retard the passage of crystals from one stage of growth to another, and seem to influence the exterior character (i. e., whether it be frail and branch-like, or otherwise) of the superstructure that grows outward from immature crystals of each of the various types. This seems to forge one more link in the chain of proof that, tho exterior conditions and environment exert a great influence in determining and modifying crystallic forms and structures, yet there is a mysterious something—individuality, or whatever it may be called—inherent within the crystals themselves, that enters into the problem of form determination. This exerts an influence causing the parent or germ crystal to impart its own peculiar habits of growth to the molecules of water that such parent crystals, as growth progresses, draw to and incorporate upon and around themselves, in the form of new growth.

(65) Merging and thickening of ice crystals.

Ice crystals of whatever type freely merge and freeze together, one to the other. They are, when first formed, and for some time thereafter, exceedingly thin as regards tabular thickness, hardly thicker in fact than thin paper, probably having a thickness between the one hundred and fiftieth of an inch and the two hundred and fiftieth of an inch. They gradually, but very surely, become thicker with age and increase in size.

(66) Variation in size.

Ice crystals, even as first formed, vary greatly also one from another in greater diameter. Many ice-crystal nuclei are mere specks, with diameters of less than one-fiftieth of an inch; while others, when they come into visible existence, possess forms of considerable size, one-fourth of an inch or even more in greater diameter. Intense cold seems to favor the formation of tiny nuclei, and a milder degree of cold that of larger nuclei. Intense cold seems to favor branch-like, and a mild temperature solid growth. Ice crystals vary much more markedly as to the ratio of thickness to diameter than do snow crystals.

Germ ice crystals, floating and growing upon the surface of calm water, seem to draw their growth material almost wholly from a thin film of chilled surface water. They seem to draw little from below. That this is the case is proved by the fact that whenever two or more crystals lie close together, or even some distance apart, growth occurs fastest and in the greatest degree upon the portions of each crystal that lie the farthest away from the neighboring crystal, or crystals. (See photographs Nos. 264 and 265.) If it were the case that they drew their growth supplies from below, their contiguity would make but little difference in the rates of growth of the crystals so situated, because the source to be drawn from would be relatively limitless.

[*To be continued.*]

METEOROLOGICAL STATIONS IN SOUTHERN NIGERIA.

C. FITZHUGH TALMAN, Assistant Librarian.

The past decade has witnessed an extraordinarily rapid extension of the network of meteorological stations in Africa. The distribution of stations eight or ten years ago is shown on the chart which forms the frontispiece of Bartholomew's Atlas of Meteorology (1899). At that time meteorological observations were well organized in Algeria and south Africa, and work had begun, in a small way, in several British colonies, under the supervision of the British Association Committee on the Climatology of Africa. A few widely scattered stations existed in the Congo State.

In 1900 a general meteorological service was organized in Egypt, and its network of stations has been pushed southward until now it includes the whole basin of the upper Nile, in the heart of central Africa, and adjoins the meteorological system of British East Africa. The latter was organized as an independent service about three years ago, and this year, 1907, embraces about 50 stations of all orders. The British Central Africa Protectorate had, in 1905, a network of 40 stations. Southern Rhodesia has 48 stations, nearly all of which are less than ten years old. (See map in the MONTHLY WEATHER REVIEW for March, 1907, p. 124.) The Transvaal had 375 stations in operation during the year 1906, of which 32 were equipped with barometers. The Orange River Colony had, in 1905, 9 second-order stations and 74 rainfall stations.

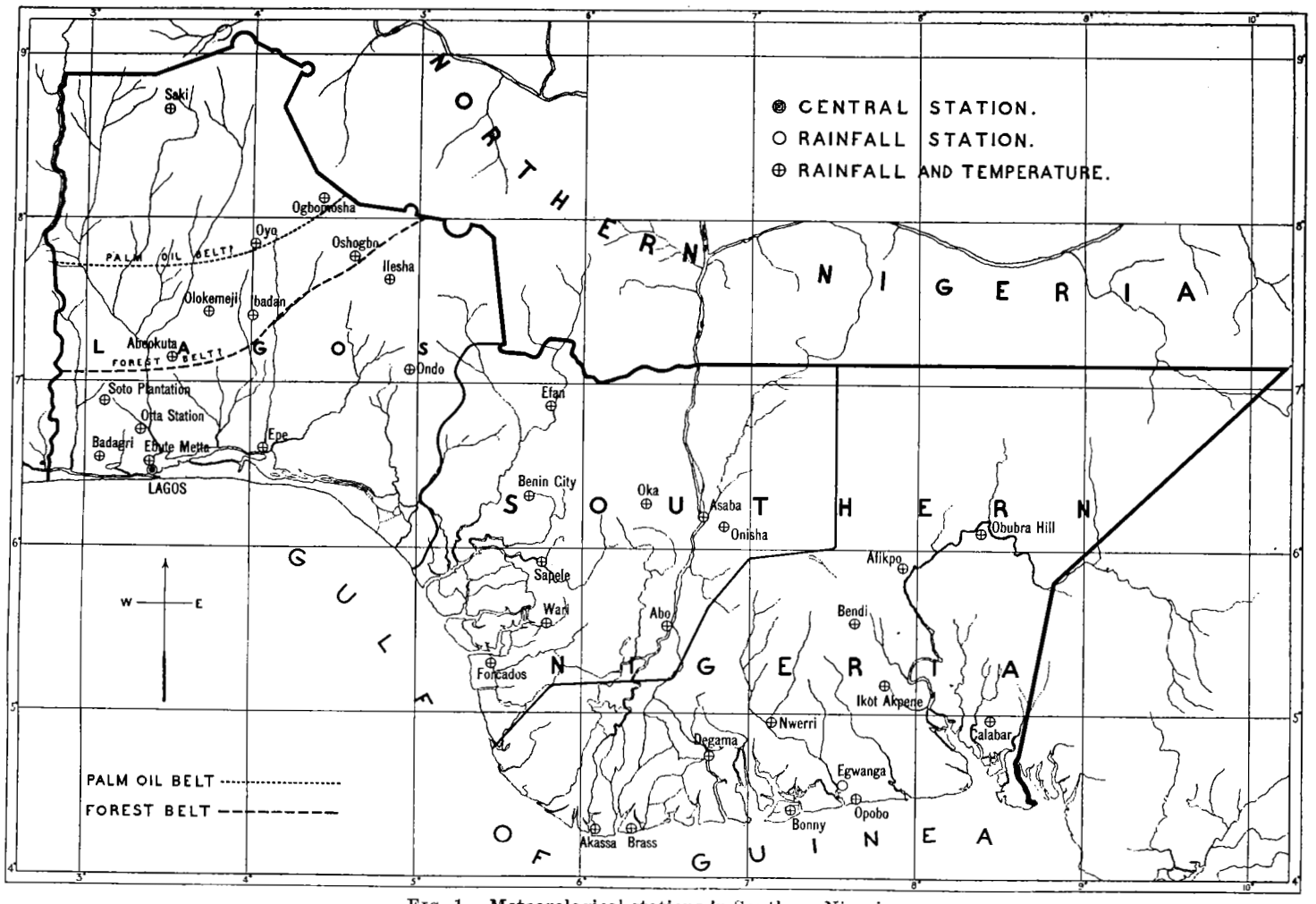

FIG. 1.—Meteorological stations in Southern Nigeria.

Meteorology has made especially rapid progress in the German possessions and protectorates, and the German observations have been very fully published—especially in Danckelman's Mitteilungen and the Überseeische Beobachtungen of the Deutsche Seewarte. From a new work by Doctor Fitzner on the rainfall of the German colonies[1] we obtain the following statistics of rainfall-reporting stations in Germany's African possessions. The enumeration, which refers to the end of 1905, includes a considerable number of stations that had been discontinued prior to that time; however, it affords an indication of the extent of territory from which climatological data are available.

Colony.		
Kamerun	30	No. of stations from which rainfall data are available.
Togo	21	
German Southwest Africa	71	
German East Africa	84	

Of the French colonies, besides Algeria, already mentioned, Tunis has a well-organized meteorological service, which in 1903 embraced 34 stations. More recent figures are not at hand.

The British colonies in west Africa include a number of meteorological stations, some of long standing, whose observations have been published mainly in the reports of the British Association and the blue books of the Colonial Office. A map of the stations in the Gold Coast Colony appeared in the MONTHLY WEATHER REVIEW of September, 1906, p. 425. We are now able, thru the courtesy of Mr. E. P. Cotton, director of surveys at Lagos, to present a chart showing the location of meteorological stations in Southern Nigeria (Fig. 1). Mr. Cotton also sends the following particulars regarding the meteorological system of Southern Nigeria, which is under the direction of the department of surveys, with headquarters at Lagos.

There are at present 36 meteorological stations in the colony of Southern Nigeria which are classified under three headings, denoting the Eastern, Central, and Western Provinces, to which they belong.

(*a*) In the Western Province there are Lagos, the central station, which has an observatory, Ebute Metta, Badagri, Epe, Olokemeji, Ondo, Ibadan, Oyo, Saki, Ilesha, Abeokuta, Oshogbo, Soto Plantation, Otta Station, and Ogbomosha, all of which are rainfall and temperature stations.

(*b*) In the Eastern Province we have Bonny, Egwanga, Calabar, Bendi, Ikot Akpene, Obubra Hill, Brass, Degama, Nwerri, Opobo, Afikpo, and Akassa; all these are rainfall and temperature stations except Egwanga, which is at present a rainfall station only, but we hope to equip it as a rainfall and temperature station shortly.

(*c*) The Central Province furnishes us with the following, viz: Forcados, Sapele, Asaba, Benin City, Efan, Onisha, Wari, Abo, and Oka, all of which are rainfall and temperature stations.

The Lagos Observatory, which is the principal station, is well equipped with barometer (Kew pattern), barograph, minimum on grass, maximum in sun; rain-gage with receiver and measuring glass; maximum mercurial thermometer, minimum spirit thermometer, and ordinary thermometer, hygrometer, besides a Dines anemometer, and other costly instruments for astronomical purposes.

The remaining or second-class stations have a maximum thermometer, minimum thermometer, rain-gage with receiver and measuring glass, and two ordinary thermometers.

Very few of these latter stations have maximum in sun and minimum on grass as well.

At the Lagos Observatory observations are made twice daily, namely, at 9 a. m. and 3 p. m., respectively, whilst only at 9 a. m. at the other stations, in order to suit the convenience of the various observers and also in consequence of their not having many instruments.

[1] Fitzner, Rudolf. Die Regenverteilung in den deutschen Kolonien. Berlin: Hermann Paetel. 1907.

These observations are taken at Lagos by the meteorological clerk, under the supervision of the director of surveys; and at the outstations mostly by the medical officers and district commissioners.

These observers in the districts are furnished with two meteorological registers each, which are to be sent alternately to Lagos at the close of each month, so that the records may be compiled there, and the register is also returned in a few days, so that the continuity of the records may not be interrupted.

The rainfall record registered in each station during the previous year stands thus:

Western Province.		Eastern Province.		Central Province.	
Station.	Inches	Station.	Inches.	Station.	Inches.
Lagos	74.76	Bonny	142.26	Forcados	98.23
Ondo	54.59	Egwanga	251.49	Sapele	106.69
Ibadan	46.40	Calabar	156.64	Asaba	44.27
Olokemeji	40.90	Bendi	87.08	Benin City	93.30
Badagri	58.34	Onisha	58.21	Efan *	27.17
Epe	60.23	Obubra Hill *	3.50		
Oshogbo	47.95	Nwerri *	80.14		
Oyo	46.60	Afikpo	90.77		
Saki *	34.32				

* Records incomplete.

The highest rainfall, 251.49 inches, was registered at Egwanga and the lowest, 40.90 inches, at Olokemeji.

THE ROYAL METEOROLOGICAL SOCIETY.

[Reprint of a circular issued by the society.]

The society was founded for the promotion of the science of meteorology in all its branches on April 3, 1850, under the title of The British Meteorological Society. On its incorporation by royal charter, on January 27, 1866, the name was altered to The Meteorological Society; and in 1883, by permission of Her late Majesty Queen Victoria, it became The Royal Meteorological Society.

In 1904 His Royal Highness the Prince of Wales honored the society by becoming its patron.

Meetings are held on the third Wednesday in each month from November to June inclusive—those in the evening being usually (by permission) at the Institution of Civil Engineers, and those in the afternoon in May and June at the society's rooms, 70 Victoria street. These occasions afford an opportunity for social intercourse between those interested in meteorology, tea being served after the evening meetings or before the meetings in the afternoon.

Exhibitions of new and special classes of meteorological instruments, as well as of diagrams, charts, and photographs, are held from time to time. Popular lectures on meteorological subjects by eminent authorities are also arranged for on special occasions.

The papers read at the meetings, together with the discussions, in which every fellow is entitled to take part, are printed in the Quarterly Journal, which also contains notes, correspondence, notices of recent publications, and the titles of such papers as appear to be of general interest bearing on meteorology in the periodicals which are received in the society's library. It thus serves to keep the fellows residing at a distance from London in touch with the meteorological work of the world.

In 1874 the society commenced the organization of a series of second-order stations, at which observations of pressure, temperature, humidity, rainfall, and wind are made on a uniform plan so that the results may be strictly comparable. In addition to these, another class of stations, termed climatological, was organized on January 1, 1880, at which the observations, altho of equal accuracy, are less exacting. These stations, which number about 100, are well distributed thruout the country; they are regularly inspected on behalf of the society, and the results of the observations are published in the Meteorological Record.

In 1874 a conference on the observation of periodical natural phenomena was organized, and as the result of their deliberations the society instituted the series of phenological observations which have been continued since that time, first under the superintendence of the late Rev. T. A. Preston, and since 1888 under that of Mr. E. Mawley.

A lightning rod conference was organized in 1878, which in 1882 published a valuable report embodying a code of rules for the erection of lightning conductors.

The society has initiated and carried out various scientific investigations, of which the following may be mentioned: (1) systematic investigations of the thunderstorms of 1888 and 1889, and the classification of the various forms of lightning; (2) inquiry into the phenomenon of the Helm Wind of Crossfell, Cumberland; (3) investigation into the relation between Beaufort's scale of wind force and the equivalent velocity in miles per hour; (4) the investigation of the meteorological conditions of the upper air by means of kites.

The Symons gold medal, founded in 1901 in memory of the late Mr. G. J. Symons, F. R. S., is awarded biennially by the council for distinguished work done in connection with meteorological science. The medal was presented to Dr. A. Buchan, F. R. S., in 1901; to Dr. J. Hann, of Vienna, in 1903; and to Lieut.-Gen. Sir R. Strachey, F. R. S., in 1905.

The society possesses a valuable meteorological library of about 8700 volumes, 12,000 pamphlets, 200 maps and charts, and 800 manuscripts, unequalled by any collection of works on this science in the world. It also possesses a unique bibliography, which contains the titles of all books, pamphlets, papers, and articles bearing on meteorology, in all languages of which any notice can be found.

In addition to these, there is a large and interesting collection of photographs and lantern slides illustrating meteorological phenomena and instruments.

With the view of advancing the general knowledge of meteorology, promoting an intelligent public interest in the science, and making the work of the society more widely known, a lecturer has been appointed to act in cooperation with scientific societies, institutions, and public schools in various parts of the country. Exhibits of selections from the collection of photographs, drawings, diagrams and charts illustrating meteorological phenomena, and also various patterns of instruments used for observations, are shown, under the charge of a member of the staff, at gatherings of local scientific societies, or on other occasions when they are likely to prove of interest.

Candidates for the fellowship are elected by ballot, after recommendation by three fellows, one of whom must certify from personal knowledge. Ladies are eligible for the fellowship. Fellows are entitled to the designation, F. R. Met. Soc.

Fellows have the privilege of attending the meetings and introducing visitors; they have the free use of the library and receive gratis the Quarterly Journal, the Meteorological Record, and the other publications of the society. The council of the society is elected by the fellows annually, and reports to the fellows at the annual general meeting.

The library and offices at 70 Victoria street, Westminster, are open daily between the hours of 10 a. m. and 5 p. m., excepting on Saturdays, when they are closed at 1 p. m. Fellows are always welcomed at the society's rooms, and the office staff is always ready to assist in supplying any meteorological information which is desired.

Every fellow pays an annual subscription of £2, or a life composition of £25, and in addition an entrance fee of £1. For fellows elected in November and December the payment of the first subscription exempts them from any contribution for the next succeeding year.

In addition to the fellows, there is a class (limited to 20) of honorary members, which is confined to distinguished foreign meteorologists.

All communications should be sent, and all money contribu-